

PATENT APPLICATION

of

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for

MEDIA ADAPTATION DETERMINATION FOR WIRELESS TERMINALS

MEDIA ADAPTATION DETERMINATION FOR WIRELESS TERMINALS

TECHNICAL FIELD

5 The invention relates to the field of media adaptation in Multimedia Messaging Service (MMS) and SIP (Session Initiation Protocol) Instant Messaging (IM) to enable interoperability. More particularly, the present invention pertains to using signaling to determine whether media adaptation (transcoding) for a telecommunications terminal must be performed.

BACKGROUND ART

10 Terminals available for multimedia messaging and so-called instant messaging have different media and network capabilities (e.g. different media formats supported, different limitation in message size and image resolution, etc.). A messaging server, such as an MMS Proxy-Relay logical
15 entity as defined in the Open Mobile Alliance (OMA) specifications of the Multimedia Messaging Service (MMS) or a SIP proxy in SIP IM, has no standard way of knowing in advance whether media adaptation--called here transcoding (to accommodate limited multimedia capabilities of the receiving
20 terminal)--is needed or not when providing a multimedia message to a terminal. Today a server must analyze all components of a message in view of the capabilities of the terminal to which the message is being sent, which means that a message must be opened to determine its relevant media
25 characteristics.

The relevant characteristics of a message include for example: image resolution, whether a JPEG (Joint Photographic Experts Group) is baseline or progressive, and the number of frames of a GIF (graphics interchange format) image. If the
30 message has multiple components (for example multiple JPEG images or multiple images of different formats) then the server has to analyze all the components of the message. For

some server implementations, such an analysis requires that for each media component, a processing component (e.g. a plugin) supporting the media type of the component be identified, and that the media component then be sent to the identified media processing component for analysis. In the simplest cases, the analysis can be performed by decoding only the beginning (e.g. header part) of the media component. Nevertheless, the analysis requires processing in respect to each media component and requires the presence of a processing component capable of the analysis. The performance penalty can be very high if the transcoding engine is located on a separate server (e.g. in case of one vendor providing the messaging server but opting to use a transcoding server provided by another vendor, as illustrated in Fig. 1).

Thus, it would be advantageous to have a mechanism by which a messaging server can determine whether transcoding/ media adaptation is needed for a message intended for a terminal without having to (open and) examine each media component of the message.

DISCLOSURE OF THE INVENTION

Accordingly, in a first aspect of the invention, a method is provided by which a multimedia message is transcoded en route from a sending terminal via a messaging server to a receiving terminal having limited multimedia capabilities, so as to be suitable for reception and presentation by the receiving terminal, the method characterized by: a step in which a user agent of the sending terminal inserts, into the message, media characteristics of the message sufficient in detail to enable determining whether the message should be transcoded to accommodate multimedia capabilities of the receiving terminal; and a step in which the messaging server reads the media characteristics and decides whether the message should be transcoded based only on the inserted media

characteristics and on actual or assumed multimedia capabilities of the receiving terminal.

In accord with the first aspect of the invention, the messaging server may send the message to a transcoding server if transcoding is needed, and the transcoding server may use the inserted media characteristics to itself decide if transcoding is needed.

Also in accord with the first aspect of the invention, the messaging server may send the message to a transcoding server if transcoding is needed, and the transcoding server may use the inserted media characteristics to itself decide which parts of the message need transcoding.

Also in accord with the first aspect of the invention, the messaging server may determine, from the inserted media characteristics, which parts of the message need transcoding and may send the message to a transcoding server if transcoding is needed for any message part, and may include in the message an indication of which parts of the message need transcoding.

Also in accord with the first aspect of the invention, the messaging server may determine, from the inserted media characteristics, which parts of the message need transcoding and may send only those message parts requiring transcoding to a transcoding server.

Also in accord with the first aspect of the invention, the method may be further characterized by: a step in which transcoding is performed based on the inserted media characteristics and the actual or assumed multimedia capabilities of the receiving terminal, without performing an analysis of the message to determine whether transcoding is needed. Further, in the step in which transcoding is performed, the transcoding may be performed without also

performing even an analysis to determine which parts of the message need to be transcoded.

Also in accord with the first aspect of the invention, the user agent may insert the media characteristics into a field in the header of the message.

Also in accord with the first aspect of the invention, the user agent may insert the media characteristics into a header field in the body of the message.

Also in accord with the first aspect of the invention, the media characteristics may include image and video resolution, or number of frames and frame rate of visual content, or sampling rate of audio content.

A second aspect of the invention provides a sending terminal, adapted for sending a multimedia message via a messaging server to a receiving terminal having limited multimedia capabilities, the sending terminal characterized by: a user agent for inserting, into the message, media characteristics of the message sufficient in detail to enable the messaging terminal to determine whether the message should be transcoded based only on actual or assumed multimedia capabilities of the receiving terminal and the inserted media characteristics.

A third aspect of the invention provides a messaging server, enhanced for determining whether to transcode a multimedia message sent from a sending terminal to a receiving terminal having limited multimedia capabilities, the messaging server characterized by: a characteristics reader and analyzer, responsive to the message, for deciding whether the message should be transcoded based only on comparing media characteristics inserted into the message with actual or assumed multimedia capabilities of the receiving terminal.

A fourth aspect of the invention provides a system, comprising a sending terminal and a messaging server, both adapted to perform according to a method by which a multimedia message is transcoded en route from the sending terminal via the messaging server to a receiving terminal having limited multimedia capabilities, so as to be suitable for reception or presentation by the receiving terminal, the system characterized in that: the sending terminal includes a user agent for performing a step of inserting, into the message, media characteristics of the message sufficient in detail to enable determining whether the message should be transcoded to accommodate multimedia capabilities of the receiving terminal; and the messaging server includes means for performing a step of reading the media characteristics and deciding whether the message should be transcoded based only on the media characteristics and on actual or assumed multimedia capabilities of the receiving terminal.

In accord with the fourth aspect of the invention, the messaging server may also include or may have access to means for performing a step in which transcoding is performed based on the inserted media characteristics and the actual or assumed multimedia capabilities of the receiving terminal, without performing an analysis of the message to determine media characteristics of the message relevant to deciding whether transcoding is needed.

Also in accord with the fourth aspect of the invention, the system may also include a transcoding server, and may be further characterized in that the messaging server is configured to send the message to the transcoding server if transcoding is needed, and the transcoding server is configured to use the inserted media characteristics to itself decide if transcoding is needed.

Also in accord with the fourth aspect of the invention, the system may also include a transcoding server, and may be further characterized in that the messaging server is configured to send the message to the transcoding server if transcoding is needed, and the transcoding server is configured to use the inserted media characteristics to itself decide which parts of the message need transcoding.

Also in accord with the fourth aspect of the invention, the system may also include a transcoding server, and may be further characterized in that the messaging server is configured to determine, from the inserted media characteristics, which parts of the message need transcoding and to send the message to the transcoding server if transcoding is needed for any message part, and to include in the message an indication of which parts of the message need transcoding.

Also in accord with the fourth aspect of the invention, the system may also include a transcoding server, and may be further characterized in that the means for transcoding is performed based on the inserted media characteristics and the actual or assumed multimedia capabilities of the receiving terminal, without performing an analysis of the message to determine whether transcoding is needed.

In a fifth aspect of the invention, a computer program product is provided comprising: a computer readable storage structure embodying computer program code thereon for execution by a computer processor in a sending terminal, said computer program code characterized in that it includes instructions for performing the steps of a method according to the first aspect of the invention and indicated as being performed by the sending terminal.

In a sixth aspect of the invention, a computer program product is provided comprising: a computer readable storage

structure embodying computer program code thereon for execution by a computer processor in a messaging server, said computer program code characterized in that it includes instructions for performing the steps of a method according to the first aspect of the invention and indicated as being performed by the messaging server.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the invention will become apparent from a consideration of the subsequent detailed description presented in connection with accompanying drawings, in which:

Fig. 1 is a block diagram/ flow diagram of a messaging system including an external transcoding/ adaptation server, according to the prior art.

Fig. 2 is a block diagram/ flow diagram of a messaging system including an external transcoding/ adaptation server, according to the invention.

Fig. 3 is a flowchart showing the operation of a messaging system according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

According to the invention, in order to enable a messaging server (e.g. an MMS Proxy-Relay in MMS, or an SIP proxy in SIP IM) to determine whether transcoding/ media adaptation is needed for a message intended for a receiving terminal, a user agent of the sending terminal inserts characteristics of each of the media components of the message into the message in a standard way (e.g. in the message header or body, according to a standard format). The messaging server examines only the inserted media characteristics information (like format profile, resolution, image-size, frame rate, etc) in deciding whether transcoding is necessary, and thus need

not examine/ open any other part of the message, making it possible to get by with less processing complexity for the messaging and transcoding servers, and yet providing a decision as to whether transcoding is necessary in less time (at least for more complex messages) than would be possible if the message had to be opened and examined in its entirety. Also, the messaging server can make a decision on transcoding without having knowledge of any given media format coding scheme (although it needs to know what media type and sometimes also what media format is being used for the message components); the messaging server operative according to the invention only needs to compare media characteristics with terminal capabilities (or adaptation targets).

The characteristics information inserted into the message by the user agent include, in addition to the usual MIME (Multipurpose Internet Mail Extensions) type information, more detailed information about the individual media components of the message such as: image resolution, and format profile (e.g. JPEG baseline or progressive, H.263 profile and level information). In e-mail, SIP messaging and MMS, because of MIME multipart usage, there are already some headers having associated fields in which corresponding information is conveyed. These headers provide some of the information of use in determining whether transcoding is necessary, headers such as the content-type header, which provides the MIME type of the message component, and the content-length header, which indicates the length of the message component. According to the invention, however, detailed characteristics such as image resolution, media profiles (JPEG baseline versus progressive, video profile and level), frame rate (for video clips), media contained in a MP4/3GPP/3GPP2 file format, and other comparable information are inserted in MIME multipart headers, for example in the content-type field of the content-type header. Such insertions enable a messaging server to know the

media properties of the incoming message. For example if a SIP IM is sent carrying a JPEG image of resolution 480x320, the content-type header field could be:

Content-type: image/JPEG; media-pix-x=480; media-pix-y=320;profile=baseline;Content-ID=<img.jpg>.

5 Such a content-type header lets the messaging server know that the incoming message is of type JPEG baseline with a resolution of 480x320. If the terminal to which the message is intended is able to display only 160x120, then the messaging server knows from the inserted characteristics and without
10 otherwise opening the message (i.e. without examining each media component of the message) that the message must be transcoded. It also knows which parts of the message needs to be transcoded and could decide to send only those parts for adaptation (either internally or to an external transcoding
15 server).

Thus, and now referring to Fig. 1, according to the prior art a sending terminal 11 sends a message to a receiving terminal 15, and in the course of delivery the message is processed by a messaging server 12. The messaging server--and
20 more specifically a message router 12a included as part of (i.e. in that it is hosted by) the messaging server 12--sends a request for adaptation to a transcoding server 14 including the message, along with the capabilities of the receiving terminal or its identity (e.g. User-Agent header). Given the
25 identity of the receiving terminal, the transcoding server 14 is usually able to look up the capabilities of the receiving terminal using an internal terminal capability database. The transcoding server 14--and more specifically a message analyzer and transcoding engine 14a included as part of
30 (hosted by) the transcoding server--then opens the message, examines each media component, and determines what if any transcoding is necessary, which it then performs. It then sends the possibly transcoded message back to the messaging

server, which forwards it to the receiving terminal. (In some prior art, instead of the message router 12a, there is a message adapter that opens the message and analyzes each part to determine which parts need adaptation and then sends only those to the transcoding server 14.)

In contrast, and now referring to Fig. 2, according to the invention, a sending terminal 21 includes a user agent 21a that inserts into a message to be sent to the receiving terminal 25, according to one or another convention such as described below, media characteristics information about the message sufficient in detail to determine whether transcoding is needed, given the capabilities of the receiving terminal. The sending terminal then sends the message to the receiving terminal 25, and in the course of delivery the message is processed by a messaging server 22 according to the invention, i.e. a messaging server 22 including a characteristics reader and analyzer module 22a for determining whether there is a need for adaptation/ transcoding of a message based on the media characteristics inserted into the message. Prior to message delivery to the receiving terminal 25, the messaging server 22 looks up the capabilities of the receiving terminal or somehow otherwise receives a specification of the capabilities, or else assumes (typically) some minimum set of multimedia capabilities, and then, using the characteristics reader and analyzer module 22a, the messaging server examines the inserted characteristics, and if transcoding is needed based on the actual or assumed multimedia capabilities of the receiving terminal 25, sends the message to a transcoding server 24 also according to the invention, i.e. the transcoding server would take into account the media characteristics information of the message when determining which components of the message require adaptation. The transcoding server can itself look up the capabilities of the receiving terminal or the messaging server can include the

capabilities with the request for transcoding. In some
embodiments, the transcoding server 24 will itself re-examine
the message and determine the transcoding needed, just as in
the prior art, so that what the invention accomplishes in such
5 embodiments is to avoid having the messaging server 22 send a
message to an external transcoding server 24 when transcoding
is not needed. Also, since in such embodiments it is
advantageous to have the messaging server be overly cautious
in determining whether transcoding is needed, it is possible
10 for the transcoding server 24 to decide that no transcoding is
needed even though the messaging server has decided otherwise
(such as e.g. if the message contains media components of a
type the messaging server is not programmed to handle and
therefore cannot determine whether the components are suitable
15 for the receiving terminal without transcoding).

After transcoding (if needed), the transcoding server 24
sends the (possibly) transcoded message back to the messaging
server, which forwards it to the receiving terminal.

Note that the transcoding engine 24a may actually be
20 hosted by the messaging server 22, and not by a separate
transcoding server, although for purposes of a more plain
comparison with the prior art as illustrated in Fig. 1, the
transcoding engine 24a is shown hosted by a separate
transcoding server 24, operated typically by a party different
25 than the party operating the messaging server 22.

In the course of transcoding, the transcoding server 24
advantageously modifies the message's media characteristics
information, which it includes in the transcoded message it
sends back to the messaging server 22. In some embodiments,
30 however, the media characteristics information is stripped
from the message. In such embodiments, if the receiving
terminal 25 later forwards the message to another terminal, a
user agent included in that terminal, acting now as a sender,

inserts again message media characteristics information in the message determined by analysing the media components of the message. The messaging server 22 can also therefore behave differently in different embodiments: in some, it strips the inserted media characteristics information and in others it retains the inserted media characteristics information.

The media characteristics can advantageously all be inserted into one or more of the headers in the message header, rather than in the message body, in order to reduce the parsing time to extract such information.

Media content characteristics

In some embodiments, the media characteristics to be inserted into a message by a user agent can include the media content characteristics indicated in Table 1.

Table 1: Media content characteristics.

Media content characteristic	Description	Media types to which it applies
Charset	Character set used (RFC 2045). Values include US-ASCII and ISO-8859-1.	Text content
Profile	Profile of the media component (e.g. Profile 0 for H.263 or baseline for JPEG).	All
Level	Level of the media component (e.g. Level 10 for H.263).	All
Media-pix-x	Horizontal resolution of the visual media component (e.g. 640 pixels). Note that for video, conformance can often be deduced from profile/level information but this media characteristic provides more detailed information and could be useful.	Visual content
Media-pix-y	Vertical resolution of the visual media component (e.g. 480 pixels). Note that for video, conformance can often be deduced from profile/level information but this media characteristic provides more detailed information and could be useful.	Visual content
Nb-frames	Number of frames in the visual media component (e.g. animated GIF or video clip). This is optional.	Visual content
Frame-rate	Frame-rate of the visual media component (e.g. 15 frames per seconds).	Visual content (e.g. video)
Sampling-rate	Sampling rate of the audio media component (e.g. 8000 Hz). This can also be implicit to the Content type. For instance audio/amr is 8000Hz.	Audio content
Nb-channels	Number of channels of the media component (e.g. stereo is 2, mono is 1). This can also be implicit to the Content type. For instance audio/amr is mono.	All
Duration	Approximate duration of the media component in milliseconds (e.g. duration of an audio or video clip, or a presentation). This is	All

Media content characteristic	Description	Media types to which it applies
	typically optional.	
Media-size	The size of the media component itself i.e. without MIME headers and encoding for transport (e.g. 5200 Bytes).	All
Content-subtype	The Content type of a media component embedded in a file format (e.g. video/H263-2000 and audio/AMR subtypes can be embedded in a video/3gpp file format). Subsequent content characteristics apply to this content-subtype (until a new content-subtype is listed). Content characteristics listed prior to all content-subtype apply to the Content-type itself as a whole.	File formats
Content-ID	Content-ID as described in RFC-2392 providing a reference to the body part to which the content description applies.	All
X-MMS-Content-Class	The list of Content Classes to which the Multimedia Message belongs to: TX = Text, IB = Image basic, IR = Image rich, VB = Video basic, VR = Video rich. E.g. TX, IB, IR. This media content characteristic is typically located in the message header.	Multimedia Message
X-Content-Description	Description of the content present in the message body. The syntax is the same as for the Content-type characteristic. In the case of multipart content, a line containing the Content-Description for each part shall be provided. This media content characteristic is located in the message header.	Multimedia Message

Table 2 describes content-specific values of profiles and level media content characteristics. For instance, Baseline and Progressive are acceptable JPEG profiles.

5 Table 2: Content-specific values of profile and level media content characteristics.

Content-type	Profile	Description	Level	Description
Image/jpeg	Baseline	Baseline DCT, non-differential, Huffman coding, as defined in table B.1, symbol 'SOF0' in "MMS v1.2 Client Transactions," by the Open Mobile Alliance (OMA).	N/A	
	Progressive	Progressive DCT, non-differential, Huffman coding, as defined in table B.1, symbol 'SOF2' in "MMS v1.2 Client Transactions," by the Open Mobile Alliance (OMA).	N/A	

Content-type	Profile	Description	Level	Description
Video/h263-2000	0 through 10 (0 and 3 are typically used for MMS)	H.263 profile number specifying the supported H.263 annexes/subparts. H.263 Baseline corresponds to Profile 0, Level 10. (See RFC 3555.)	0 - 100	Level of bitstream operation specifying the level of computational complexity of the decoding process. H.263 Baseline corresponds to Profile 0, Level 10. (See RFC 3555.)
Application/smil	SMIL-CONF-1-2	Indicates one or more base sets of SMIL modules that the client supports. "SMIL-CONF-1-2" identifies the SMIL base set and associated limitations defined in "MMS Conformance Document," version 2.0.0, February 2002, by CMG, Ericsson, Nokia, Sony-Ericsson, Comverse, Logica, Siemens, and Motorola; and in "MMS Conformance Document," version 1.1, August 2001, by Ericsson, Nokia.		
	SMIL-3GPP-R4	Predefined values for base sets defined in "Transparent end-to-end Packet-switched Streaming Service (PSS); Protocols and codecs," Third Generation Partnership Project, 3GPP TS 26.234, Rel 4.		
	SMIL-3GPP-R5	Predefined values for base sets defined in "Transparent end-to-end Packet-switched Streaming Service (PSS); Protocols and codecs," Third Generation Partnership Project, 3GPP TS 26.234, Rel 5.		

Table 3 describes MPEG-4 Visual Profile values of profile-level-id media content characteristic.

Table 3: Content-specific values of profile and level media content characteristics.

Content-type	Profile-level-id	Description
Video/mp4v-es	Decimal value (a value of 1 specifies MPEG-4 Visual Simple Profile Level 1)	A decimal representation of MPEG-4 Visual Profile and Level indication value (profile_and_level_indication) defined in Table G-1 of ISO/IEC 14496-2. See ISO/IEC 14496-2:1999, "Information technology - Coding of audio-visual objects - Part2: Visual," and see ISO/IEC 14496-2:1999/Amd.1:2000, "Information technology - Coding of audio-visual objects - Part 2: Visual, Amendment 1: Visual extensions."

Representation of media content characteristics in messages

The invention encompasses many ways to represent media content characteristics in a message. Among the many encompassed is an embodiment in which the media content characteristics are represented as parameters of the MIME content-type header field for the body parts specified in RFC 2045. In such an embodiment, the media content characteristics are part of the message body, and indicated in ***bold-italic*** in Message Fragment 1, which is an example of an MMS message after alteration (insertion of media characteristics) by the user agent in the sending terminal 21.

Message Fragment 1: Media content characteristics represented as parameters of the MIME content-type header field, i.e. as content-type parameters in message body.

MMS Headers

X-Mms-Message-Type: M-send.req
X-Mms-Transaction-ID: 0123456789
X-Mms-MMS-Version: 1.3
From: +123/TYPE=PLMN
To: +456/TYPE=PLMN
Subject: My holidays
Content-type: application/vnd.wap.multipart.related;
type = "application/smil";
start = "<0000>";

Message Body

Content-type: application/smil; ***profile=SMIL-3GPP-R5***
Content-ID: <0000>
.... SMIL presentation file....
Content-type: image/jpeg; ***media-pix-x=640; media-pix-y=480; profile=Baseline; media-size=32768***
Content-ID: <image1.jpg>
.... jpeg-image....
Content-type: text/plain; charset="us-ascii"; ***media-size=512***
Content-ID: <text.txt>
.... text....
Content-type: audio/amr; ***media-size=5000***
Content-ID: <audio.amr>
.... audio....
Content-type: video/3gpp; ***media-size=44000; Duration=10000; Content-subtype=video/h263-2000; Profile=0; level=10; Frame-rate=15; media-size=40000; Content-subtype=audio/amr; media-size=4000***
Content-ID: <video.3gp>
.... audio+video clip....

In another embodiment, the media content characteristics are represented as parameters of the proposed content-description header field part of the message header. This is illustrated in Message Fragment 2. This method has the

advantage that one doesn't need to parse through the message body to extract the relevant information which can improve performance furthermore. Also, it allows global description of the content. For instance, it allows indicating to which MMS message classes the message belongs to (see X-Mms-Content-Class descriptor). The content description is linked to the body part through the use of the Content-ID parameter.

Message Fragment 2: Example of MMS message with media characteristics as content-description parameters in message header.

MMS Headers

```
X-Mms-Message-Type: M-send.req
X-Mms-Transaction-ID: 0123456789
X-Mms-MMS-Version: 1.3
From: +123/TYPE=PLMN
To: +456/TYPE=PLMN
Subject: My holidays
Content-type: application/vnd.wap.multipart.related;
type = "application/smil";
start = "<0000>";
X-Mms-Content-Class = "VB,VR"
X-Content-Description: application/smil; profile=SMIL-3GPP-R5; Content-ID=<0000>
X-Content-Description: image/jpeg; media-pix-x=640; media-pix-y=480; profile=Baseline;
media-size=32768; Content-ID=<image1.jpg>
X-Content-Description: text/plain; charset="us-ascii"; media-size=512; Content-
ID=<text.txt>
X-Content-Description: audio/amr; media-size=5000; Content-ID=<audio.amr>
X-Content-Description: video/3gpp; media-size=44000; Duration=10000; Content-
subtype=video/h263-2000; Profile=0; level=10; Frame-rate=15; media-size=40000;
Content-subtype=audio/amr; media-size=4000; Content-ID=<video.3gp>
```

Message Body

```
Content-type: application/smil
Content-ID: <0000>
.... SMIL presentation file....
Content-type: image/jpeg
Content-ID: <image1.jpg>
.... jpeg-image....
Content-type: text/plain; charset="us-ascii"
Content-ID: <text.txt>
.... text....
Content-type: audio/amr
Content-ID: <audio.amr>
.... audio....
Content-type: video/3gpp
Content-ID: <video.3gp>
.... audio+video clip....
```

An essentially equivalent embodiment is one in which the media characteristics are represented using the content-features header in a manner described in RFC 2912, as shown in Message Fragment 3.

Message Fragment 3: Example of MMS message with media characteristics as content-feature parameters in message body.

MMS Headers

X-Mms-Message-Type: M-send.req
X-Mms-Transaction-ID: 0123456789
X-Mms-MMS-Version: 1.3
From: +123/TYPE=PLMN
To: +456/TYPE=PLMN
Subject: My holidays
Content-type: application/vnd.wap.multipart.related;
type = "application/smil";
start = "<0000>";

Message Body

Content-type: application/smil
Content-features: (profile=SMIL-3GPP-R5)
Content-ID: <0000>
.... SMIL presentation file....
Content-type: image/jpeg
Content-features: (& (media-pix-x=640)(media-pix-y=480) (profile=Baseline)(media-size=32768))
Content-ID: <image1.jpg>
.... jpeg-image....
Content-type: text/plain; charset="us-ascii"
Content-features: (media-size=512)
Content-ID: <text.txt>
.... text....
Content-type: audio/amr
Content-features: (media-size=5000)
Content-ID: <audio.amr>
.... audio....
Content-type: video/3gpp
Content-features: (& (media-size=44000)(Duration=10000)
(& (Content-subtype=video/h263-2000)(Profile=0)(level=10)(Frame-
rate=15)(media-size=40000))
(& (Content-subtype=audio/amr)(media-size=4000)))
Content-ID: <video.3gp>
.... audio+video clip....
.... audio....
Content-type: video/3gpp
Content-features: (& (media-size=44000)(Duration=10000)
(& (Content-subtype=video/h263-2000)(Profile=0)(level=10)(Frame-
rate=15)(media-size=40000))
(& (Content-subtype=audio/amr)(media-size=4000)))
Content-ID: <video.3gp>
.... audio+video clip....

Another possibility is to have the media content characteristics be represented as parameters of the content-features as part of the message header, as indicated in Message Fragment 4. This method has the advantage that one doesn't need to parse through the message body to extract the relevant information which can improve performance furthermore. Also, it allows global description of the content. For instance, it allows indicating to which MMS

message classes the message belongs to (see X-Mms-Content-Class descriptor).

Message Fragment 4: Example of MMS message with media characteristics as content-feature parameters in message header.

MMS Headers

```
X-Mms-Message-Type: M-send.req
X-Mms-Transaction-ID: 0123456789
X-Mms-MMS-Version: 1.3
From: +123/TYPE=PLMN
To: +456/TYPE=PLMN
Subject: My holidays
Content-type: application/vnd.wap.multipart.related;
type = "application/smil";
start = "<0000>";
Content-features: ( & (Type= "application/smil")(profile=SMIL-3GPP-R5) (Content-ID=<0000>))
Content-features: ( & (Type= "image/jpeg")(media-pix-x=640)(media-pix-y=480)(profile=Baseline)(media-size=32768) (Content-ID=<image1.jpg>))
Content-features: ( & (Type= "text/plain")(charset=us-ascii)(media-size=512)( Content-ID=<text.txt> )
Content-features: ( & (Type= "audio/amr")(media-size=5000) (Content-ID=<audio.amr>))
Content-features: ( & (Type= "video/3gpp")(Duration=10000)(media-size=44000)(Content-subtype=video/h263-2000)(Profile=0)(level=10)(Frame-rate=15)(media-size=40000)( Content-subtype=audio/amr)(media-size=4000) (Content-ID=<video.3gpp>))
```

Message Body

```
Content-type: application/smil
Content-ID: <0000>
.... SMIL presentation file....
Content-type: image/jpeg
Content-ID: <image1.jpg>
.... jpeg-image....
Content-type: text/plain; charset="us-ascii"
Content-ID: <text.txt>
.... text....
Content-type: audio/amr
Content-ID: <audio.amr>
.... audio....
Content-type: video/3gpp
Content-ID: <video.3gp>
.... audio+video clip....
```

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Note that it is possible to provide media characteristics in both the message header and body. If there is a contradiction between them, which should not normally happen, a method to resolve the conflict can be defined. For instance the message header information can be defined to have precedence since it is likely to be the only information used by a messaging

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server if present and complete (i.e., if complete, it would not even parse the message body).

Comparison of media characteristics with terminal capabilities

In order to determine if the message content is suitable for a given terminal, the media characteristics present in the message header or body must be compared with the terminal capabilities. The terminal capabilities can be obtained through a wide variety of methods including terminal capability databases, user terminal profile databases, and UAProf. For instance, Table 4 summarizes the attributes defined within the MMS Characteristics component in MMS v1.2. (See: "MMS v1.2 Client Transactions," Open Mobile Alliance (OMA), at <http://www.openmobilealliance.org>).

Table 4: Terminal attributes defined within the MMS Characteristics component in MMS v1.2.

Attribute	Description	Resolution Rule	Type	Sample Values
Component: MMS Characteristics				
MmsMaxMessageSize	The maximum size of a multimedia message in bytes.	Locked	Number	20480
MmsMaxImageResolution	The maximum size of an image in units of pixels (horizontal x vertical).	Locked	Literal	"80x60"
MmsCcppAccept	List of supported content types conveyed as MIME types.	Locked	Literal bag	"image/jpeg", "audio/wav", "video/mpeg-4"
MmsCcppAcceptCharSet	List of character sets that the MMS Client supports. Each item in the list is a character set name registered with IANA.	Locked	Literal bag	"US-ASCII", "ISO-8859-1"
MmsCcppAcceptLanguage	List of preferred languages. The first item in the list should be considered the user's first choice. Property value is a list of natural languages, where each item in the list is the name of a language as defined by RFC 1766.	Locked	Literal bag	"en", "fr"
MmsCcppAcceptEncoding	List of transfer encodings that the MMS Client supports. Property value is a list of transfer encodings, where each item in the list is a transfer encoding name as specified by	Locked	Literal bag	"base64", "quoted-printable"

Attribute	Description	Resolution Rule	Type	Sample Values
Component: MMS Characteristics				
	RFC 2045 and registered with IANA.			
MmsVersion	The MMS versions supported by the MMS Client conveyed as majorVersionNumber.minorVersionNumber.	Locked	Literal bag	"2.0", "1.3"
MmsCcppStreamingCapable	Indicates whether the MMS Client is capable of invoking streaming.	Locked	Boolean	"Yes", "No"
MmsSmilBaseSet	Indicates one or more base sets of SMIL modules that the client supports. "SMIL-CONF-1-2" identifies the SMIL base set and associated limitations defined in MMS CONF (MMS Conformance document of the OMA MMS specifications v 1.2). Predefined values for base sets defined in 3GPP TS 26.234 may also be used (e.g. SMIL-3GPP-R and SMIL-3GPP-R).	Locked	Literal bag	"SMIL-CONF-1-2"
X-Mms-Content-Class	List of supported MM Content Classes: TX = Text; IB = Image basic; IR = Image rich; VB = Video basic; and VR = Video rich;	Locked	Literal bag	"TX", "IB", "IR", "VB", "VR"
MmsSuppressContentAdaptation	Requests that MMS Proxy-Relay performs no content adaptation.	Locked	Boolean	"Yes", "No"

The messaging server determines the need for adaptation by comparing the media characteristics with the terminal capabilities. Adaptation is required if: the media characteristics are not supported by the terminal (e.g. message size is too large or MMS message class not supported); or the message contains any component for which the MIME content-type is not supported by the terminal; or the message contains components for which the characteristics are not supported by the terminal and would cause interoperability problems (such as e.g. the resolution is too large for what

the terminal can support, or the profile or level of the component is not supported, and so on).

Table 5 indicates how media characteristics and terminal capabilities can be compared in the case of an MMS terminal in order to determine whether transcoding (of an MMS message) is needed.

Table 5: Comparison of media characteristics and UAProf capabilities in MMS.

Media characteristic	UAProf descriptor	Condition for the content to be suitable for the terminal
X-Mms-Content-Class	MmsContentClass	The intersection between X-Mms-Content-Class media characteristic and UAProf's MmsContentClass must be non-empty.
Media-size at message level	MmsMaxMessageSize	Media-size at message level must not exceed MmsMaxMessageSize.
Content-type, Content-subtype, Content-Description	MmsCcppAccept	All MIME type values of content-type, content-subtype and content-description must be element of MmsCcppAccept.
Media-pix-x and Media-pix-y	MmsMaxImageResolution	Media-pix-x by Media-pix-y must not exceed MmsMaxImageResolution.
Charset	MmsCcppAcceptCharSet	Charset value must be element of MmsCcppAcceptCharSet.
Content-Encoding	MmsCcppAcceptEncoding	Content-Encoding must be element of MmsCcppAcceptEncoding.
Profile (for application/smil)	MmsSmilBaseSet	Profile of an application/smil content-type must be element of MmsSmilBaseSet.

Currently, MMS terminals do not report image and video relevant profiles/ capabilities (such as JPEG baseline or progressive, H.263 profile and level). Thus, to implement the invention, MMS terminals need to be enhanced to provide such information so that the terminal capabilities can be compared with media characteristics as described above. In case of an MMS terminal not so enhanced, and when terminal capabilities are not otherwise available, the invention can be practised assuming that the most basic profile and level is supported by the terminal (e.g. JPEG baseline or H.263 Profile 0 level 10 if video is supported). But when available, profile and level information (or profile-level-id) should of course be compared.

Referring now to Fig. 3 (and still also to Fig. 2), the invention is shown as providing a method including a first step 31 in which the sending terminal's user agent 21a inserts media characteristics information in a message (after possibly analyzing each media component) intended for the receiving terminal 25. In a next step 32, the sending terminal 21 sends the message to the receiving terminal 25, with the result that the message arrives at the messaging server 22 en route to the receiving terminal. In a next step 33, the messaging server reads the inserted media characteristics, compares them with actual or assumed capabilities of the receiving terminal (actual being obtained e.g. by a look up), and decides whether there is a need for any transcoding. If transcoding is not needed, then in an optional next step 37, the messaging server removes the inserted media characteristics (possibly based on type of receiving terminal), and in a next step 38 the messaging server sends the message to the receiving terminal. If however transcoding is needed (according to the comparison made by the messaging server), then in a next step 34 the messaging server sends the message to the transcoding server 24 (assumed here to be external to the messaging server, but could also be hosted by messaging server) for transcoding (along with an indication of the capabilities of the receiving terminal or its identity information for use in possibly obtaining the capabilities of the receiving terminal, as explained above). In a next step 35 the transcoding engine hosted by the transcoding server transcodes the message based on the capabilities of the receiving terminal, possibly using the inserted media characteristics as a guide to what needs to be transcoded in order to save analysis. Then in a next step 36, the transcoding engine returns the message to messaging server. Then, optionally, the messaging server optionally performs step 37 in which it removes the inserted media

characteristics. Finally, the messaging server sends the message to the receiving terminal (in step 38).

As explained above, the invention provides both a method and corresponding equipment consisting of various modules providing the functionality for performing the steps of the method. The modules may be implemented as hardware, or may be implemented as software or firmware for execution by a processor. In particular, in the case of firmware or software, the invention can be provided as a computer program product including a computer readable storage structure embodying computer program code--i.e. the software or firmware--thereon for execution by a computer processor.

It is to be understood that the above-described arrangements are only illustrative of the application of the principles of the present invention. In particular, the invention applies to a wide range of messaging servers including MMS Proxy-relays, SIP messaging servers, e-mail servers, and others. Also, the terminals are not limited to wireless terminals but include PCs, PDAs, and other kinds of terminals able to be used for communication. Further, the term *multimedia message* should be understood to include any message containing multimedia content, including e.g. one or more of the following kinds of content: images, video, audio, and text, as well as other kinds of content. In addition, the transcoding server can be an external server to the messaging server or be an internal process handling transcoding within the messaging server. Finally, numerous modifications and alternative arrangements may be devised by those skilled in the art without departing from the scope of the present invention, and the appended claims are intended to cover such modifications and arrangements.